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THE USE OF NATIONAL IMAGERY INTELLIGENCE ASSETS TO OBTAIN
BATTLE DAMAGE ASSESSMENT OF TACTICAL BATTLEFIELD TARGETS

By

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The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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Abstract

THE USE OF NATIONAL IMAGERY INTELLIGENCE ASSETS TO OBTAIN
BATTLE DAMAGE ASSESSMENT OF TACTICAL BATTLEFIELD TARGETS

During Operation Desert Storm and Operation Allied Force, national imagery assets were used to assist in the battle damage assessment of attacks on tactical battlefield assets such as tanks, artillery and armored vehicles. The results of these efforts, even when fused with intelligence from other sources, were often inaccurate and exaggerated.

Although national assets increase the amount of intelligence available to the operational commander, their effectiveness when used to assess tactical targets does not justify their being removed or prioritized away from national and strategic intelligence efforts.

Operational and theater commanders should reevaluate the use of national imagery intelligence assets to collect battle damage assessment of strikes against tactical targets.

Introduction

In the last decade of the twentieth century, the United States was involved in two major campaigns, Operation Desert Storm and Operation Allied Force. In both campaigns, tactical battlefield targets such as tanks, artillery and armored fighting vehicles were seen as force oriented decisive points and targeted with United States and coalition forces. Several means were used to track the effectiveness of the attacks on these targets, from small tactical unmanned aerial vehicles (UAVs) to imagery intelligence satellites. Despite the use of all these intelligence assets, both campaigns pointed out deficiencies with the ability of the operational commander to determine accurately the effect of these attacks and even the amount of damage inflicted by them. Owing to the problems in determining damage to these smaller battlefield targets, the role of all these intelligence, surveillance and reconnaissance (ISR) assets in the next conflict must be evaluated. Of particular interest is the potential role of imagery intelligence satellites in assessing damage to tactical targets. Three basic questions emerge: Can national imagery intelligence satellites be used effectively for determining damage to tactical targets? If they do have capability should they be used in this fashion? And finally, if these assets are used in this fashion, how could they best be employed?

Background

To discuss these issues in depth, some definitions should be addressed. As discussed in joint doctrine, two terms at the heart of this discussion are combat assessment and battle damage assessment. Combat assessment is one of the six parts of the targeting process, aimed at determining the overall effectiveness of the force

employed during military operations.¹ Battle damage assessment (BDA) in turn is one of the three parts of combat assessment. BDA itself is divided into three parts. The first is physical damage, the second functional damage, and the third weapon system damage.² To better illustrate the process of BDA, consider an attack against a factory manufacturing armored vehicles. An example of a physical damage assessment would be the confirmation of a weapon impact on a particular part of a building. A functional damage assessment might conclude that a certain percentage of machining equipment was damaged. A target system assessment would determine that this particular factory would only be able to operate at 50 percent capacity for two weeks until the damage is repaired.

Keeping the example above in mind, it should be clear that the physical damage assessment is the "easy" part of BDA. The physical assessment can even be made in near-real time by video from a weapon or an aircraft. The functional and target system assessments require more information about the target and the effect of the attacks. As will be discussed further, these are the assessments that are actually most important to the operational commander.

There are many other ISR assets involved in imagery intelligence. These include theater assets, such as the U-2, and tactical assets, such as UAVs. For the purposes of this paper, the term national imagery intelligence satellites will refer to sensors that are normally used to support national-strategic decision-makers and do not generally come under the direct control of the combatant commander.* In this context, when these

* Signals Intelligence (SIGINT) is also provided by satellites and would assist in BDA efforts, but a discussion of satellite SIGINT and its use in BDA is beyond the scope of this paper.

satellites are referred to, the associated staff of personnel involved in the dissemination and analysis of the collected intelligence should also be included.

As can be expected, much of the data regarding intelligence systems is classified. There are numerous open source publications that provide estimates of U.S. imagery intelligence (IMINT) satellites' capabilities. While the knowledge of the actual capabilities of these systems is not essential to an analysis of their employment, some basic capabilities and limitations need to be pointed out for a relative comparison to other IMINT assets. While many sources proport to provide the actual number of satellites in use at any time, it is sufficient to note that there are a limited number of these satellites in operation on any given day.³ Even if the number of actual satellites in orbit could be increased in a surge scenario, it is unlikely that the number of trained analysts could be increased in the short-term. As far as the resolution of these systems, as demonstrated by their use in prior conflicts, these systems are generally regarded as being capable of providing the necessary resolution to collect BDA on battlefield targets.⁴

With a basic understanding of the process and collection of BDA, and with some understanding of the assets themselves, their use in two recent conflicts will be addressed.

Two Case Studies: Operation Desert Storm and Operation Allied Force and the Years in Between

Operations Desert Storm and Allied Force are two recent case studies to evaluate the use of national assets for BDA of tactical targets. BDA was considered one of the major deficiencies in Operation Desert Storm and many changes were recommended and

implemented between the conflicts.⁵ Despite these changes, many similar problems were encountered in Operation Allied Force.

When evaluating these two campaigns, care must be taken when looking at the lessons from these conflicts. First, the “fog of war” seems to have great persistence over the battlefield and years later much important information is still contested.[†] While this lack of information should be expected and planned for while fighting a conflict, it presents challenges for any research into these conflicts. Additionally, it should be clear that the United States and its partners were victorious in both campaigns by a comfortable margin. One would ask why the United States would want to change what has so far been a winning plan. The deficiencies on both these campaigns will likely have implications on the next conflict as to where and how the operational commander uses all the imagery intelligence assets at his disposal, whether they are national, theater, or tactical in nature. Despite the best of intentions and the best spending, imagery intelligence assets will always be limited and as with any scarce asset, the ways they are employed must be evaluated.

Operation Desert Storm

According to General Norman Schwartzkopf, the Central Command (CENTCOM) Commander in Operation Desert Strom, “BDA...was one of the major areas of confusion.”⁶ The job of accounting for ground targets destroyed by aircraft was

[†] As will be discussed in further detail later, much of the data regarding the number of targets struck from both conflicts is still contested among the various agencies and services. This is not surprising and should not be viewed as isolated to these two conflicts.

given to the Army component commander's intelligence staff, who had "little idea of how to do this."⁷ A post-war study focused on BDA claims within the three Republican Guards heavy divisions. CENTCOM reported that 388 of the approximately 846 tanks in these divisions were destroyed prior to the start of the ground fighting.⁸ Post-war analysis revealed that only 146 had actually been destroyed, an error of 134 percent.⁹ General Schwarzkopf had set an objective of 50 percent of the Iraqi armor to be destroyed by air prior to commencing the ground fighting. The actual number destroyed was roughly 20 percent of the Iraqi tanks in theater. While the errors are glaring, in a larger sense they were irrelevant to the overall campaign. The ground portion of the campaign was a success. CENTCOM had overestimated the number of tanks destroyed, but underestimated that effect on the Iraqi divisions' ability to fight. To discuss this in terms of the different parts of BDA, while the physical damage assessment (numbers of tanks destroyed) was in error, the weapon system assessment (capability of the armored division to achieve its objective) was correct. As General Schwarzkopf's stated in his testimony before Congress, "About a week before the ground attack, I made the statement that the Iraqi military was about to fall apart."¹⁰

Although some sources attributed national satellite imagery as the "primary source of information for bomb damage assessment" in Operation Desert Storm¹¹, national imagery intelligence satellites were far from the only means used to determine BDA in Operation Desert Storm. Tactical and theater imagery assets were also used. What is noteworthy about the use of national imagery intelligence satellites is the strain that it put on the national agencies supporting the campaign. "At the height of the war, close to one-third of the Defense Intelligence Agency's (DIA) several thousand

employees were involved in assisting the war effort. For the first time, the Soviet Union took a back seat to another part of the world as an intelligence collection target.”¹² In fairness, it should be noted that there were strategic attacks on targets in and around Baghdad going on simultaneously with the attacks on tactical targets in Kuwait, and no doubt many of the personnel above were involved with those strategic efforts.

The US military took many steps to improve the problems encountered during Desert Storm. Joint doctrine has addressed combat assessment, although as of this writing it is still unpublished. Many programs, such as UAVs and improved intelligence dissemination systems, were developed and improved in the aftermath of Operation Desert Storm. Although many of these programs were not yet mature, with the lessons of Operation Desert Storm to learn from, it would be logical to expect to see improvements in BDA in the next conflict. Despite these improvements, Operation Allied Force would demonstrate some of the same problems seen in Operations Desert Storm, as well as show some new problems.

Operation Allied Force

Even more so than with Operation Desert Storm, there is still some controversy surrounding the BDA numbers from Operation Allied Force. NATO claims during and immediately after the conflict indicated approximately 120 Serbian tanks had been destroyed.¹³ Several months after the conflict, a report to Congress indicated that 91 “successful hits” had been confirmed and shows an additional 90 hits due to decoys, multiple hits, or “possible hits that cannot be confirmed.”¹⁴ Note that the report only

discusses "hits" and not "destroyed vehicles" and even goes further in saying, "the assessment provides no data on ...the level of damage inflicted on targets that were struck."¹⁵

These BDA findings were challenged in two national news magazines. U.S. News and World Report asserted a "NATO team that visited 900 aim points targeted by NATO in Kosovo found carcasses of only 26 tanks and similar-looking self-propelled artillery pieces."¹⁶ Almost one year later, Newsweek spoke of a suppressed Air Force report that credited the air operations with only 14 tanks and 18 armored personnel carriers.¹⁷

While the actual number of tanks destroyed will probably never be known, the point to take away from this discussion is that despite improvements in intelligence and weapons systems, there appears to have been little progress made towards improving the accuracy of BDA of tactical battlefield targets.

As with Operation Desert Storm, BDA for Operation Allied Force was gathered from many types of imagery intelligence assets. An assessment of exactly how each of these assets were used in terms of targets they were directed against and their effectiveness would be difficult to obtain, as most assessments were probably the result of fused or all-source intelligence, taking inputs from a variety of inputs.[‡]

[‡] Another hurdle to any type report on the contribution of the different ISR assets used to generate all-source intelligence would likely be the inter-agency and inter-service rivalries and competition for appropriations. Each service and agency has a vested interest in detailing its contribution to the intelligence effort. To the author's knowledge, there is no published, unclassified report detailing the contribution of the various ISR assets to the overall BDA picture.

With respect to using national assets at the operational level, Operation Allied Force introduced a new concept. In an effort to provide more national-level information to the supported commander than in Operation Desert Storm, a “federated” intelligence process was used “to facilitate burden-sharing among intelligence process centers worldwide.”¹⁸ Although Joint Task Force (JTF) Noble Anvil had been formed for Operation Allied Force, the intelligence requirements exceeded the capabilities of the JTF intelligence staff, known as the J-2. The European Command (EUCOM) Joint Analysis Center (JAC) in Molesworth, UK provided assistance.¹⁹ Furthermore, units and agencies in the United States provided assistance to the JTF Noble Anvil J-2 also. This process, going beyond the combatant commander’s command structure for intelligence, came to be called “reachback” and in general was seen as an innovative use of scarce forces.²⁰ The impact of this improved ability for the operational commander to routinely task forces outside his theater will be explored below.

Analysis & Recommendations

Can National Imagery Intelligence Satellites be used for Tactical BDA?

The answer to this question would have to be yes; national imagery intelligence satellites assets can be used to support the operational commander in gathering BDA on battlefield targets such as tanks and artillery. The open-source information on the currently fielded systems demonstrates that these systems will have the resolution required to collect intelligence on tactical battlefield targets. National imagery intelligence satellites also have several obvious advantages over other imagery assets,

including relative invulnerability to direct enemy action, little risk of escalation, and no support required by other units in theater.

While the advantages are numerous, it is worthwhile to discuss some of the disadvantages of these assets. The current IMINT satellites in use are in an orbit that varies between 120 and 300 miles from the earth's surface.²¹ Image quality will vary widely with the distance the satellite is at any given point. Although the best possible resolution may be required at some given time, the requirement may be impossible to meet given the constraints on the satellites' relatively fixed orbit. Another problem with resolution is the height of the satellite relative to the Earth. As was stated above, the IMINT satellites are postulated to have an imagery system with resolution sufficient to provide BDA of tactical battlefield targets. Assuming the same imaging technology would be available to an air-breathing asset, such as a U-2C or a high-altitude UAV, the air-breathing asset will return higher resolution images by nature of being closer. Any increase in resolution would likely increase the accuracy of the BDA and would possibly mitigate some of the problems discussed earlier.

Another disadvantage is that the track of the satellites is predictable and predicted at several sites on the world wide web. One web site that offers such a service is even thoughtful enough to offer a world map, shown below, illustrating from where the various requests for the satellites' position are coming. Just as the United States has learned the lessons from the last conflict, so have our potential enemies. With such a predictable and known ground track, imagery satellites can be thwarted passively by concealing or camouflaging potential targets. An enemy can also actively spoof these satellites, although this would require a more sophisticated effort.

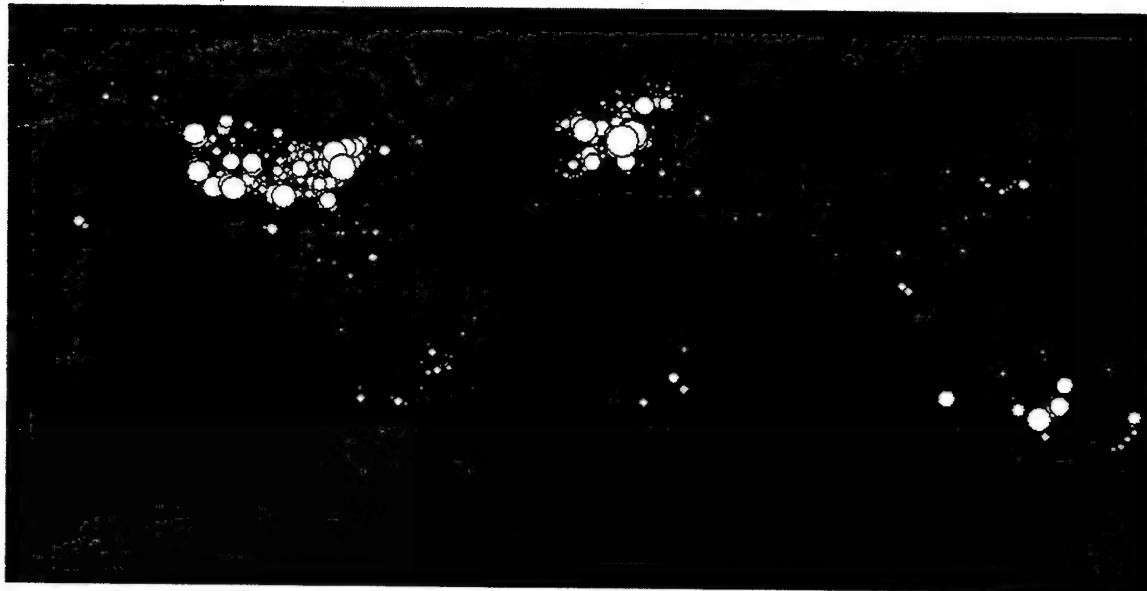


Figure 2 – Geographic Distribution of Visitors to a Satellite Tracking Website²²

Tactical battlefield targets also present challenges to BDA when compared to fixed structures, such as bridges or buildings, in one crucial area: they can be moved. Physical damage to a bridge or building is difficult to conceal or quickly repair. Tactical targets such as tanks and other vehicles may be quickly repaired or removed for repair. The time between the attack and the BDA is much more important when dealing with tactical targets and the relatively “fixed” schedule of satellite passes may be a significant disadvantage. Other IMINT assets, such as UAVs and aircraft, are more flexible in their availability and can often collect imagery while the attack is underway or shortly thereafter.

The last area where IMINT satellites are at a disadvantage is in the case of night or bad weather. This is not different than any other aerial or space vehicle except that satellites have an inability to get “under the weather” and photo-imagery satellites are

degraded by any cloud cover. During the first 47 days of Operation Allied Force, only 6 days were considered "favorable" and 14 were considered "favorable/marginal." The remaining 27 days were considered "marginal" to "unfavorable."²³ In these cases BDA would have to be obtained with radar imaging or infrared sensors, either aircraft or space-based.

Should National Imagery Intelligence Assets be used for Tactical BDA?

One of the first issues to consider when addressing this issue is the effectiveness of national imagery intelligence assets when performing tactical BDA. When looking at the conflicts above, it is clear that the intelligence effort, using all means available, fell short of the objectives with respect to BDA. Does this mean that BDA on tactical battlefield targets should be disregarded altogether? Certainly not, but the use of national imagery intelligence assets should receive special scrutiny because of their capability to be used in a national-strategic context. A U-2 or a UAV is of little use in obtaining imagery of sites deep inside the former Soviet states or the People's Republic of China, but national imagery intelligence satellites perform these functions. It is the American way of war to use overwhelming force in a conflict, and here "force" is meant to include ISR assets as well as more traditional forces. It is hard to quantify the day-to-day contribution of national imagery intelligence assets to overall national security, but suffice to say that it is not a "zero-sum game." As was mentioned in reference to Operation Desert Storm, if these limited assets, and their limited staff of analysts, are used for what is essentially a tactical, and occasionally operational function, there are other areas of the world that will forgo national attention.

If national assets are continually used for tactical BDA, there will be a growing expectation among commanders that this support will always be available. Theater contingency plans are devised based on the amount of forces that can be expected to be available to the operational commander. It is difficult to imagine the availability of national imagery intelligence assets to operational commanders if the United States was involved in one or two major theater wars. To put Operation Allied Force in perspective, the conflict lasted 78 days and even by the best estimates led to the confirmed destruction of about 600 tanks, armored personnel carriers and other military vehicles. Yet the expectation, based on previous conflicts, is that any means available will be used for tactical BDA.

Another pitfall with the increased use of national sensors for tactical BDA is that it tends to lead to an emphasis on numbers. Counting the numbers of enemy targets destroyed is a necessary function of intelligence. However, there is an increasing tendency to forget that the physical damage done to targets is not an end to itself and just a means to the larger end, that of the operational commander's objective. It is much harder to quantify or describe in a press conference the actual combat power remaining in an armored battalion, although that combat power is really what characterizes the capabilities of that unit.

Although the uniformed services seem to be aware of this, they cannot help but contribute to the problem by supplying the media with as much raw data as possible. Consider the comments of Major General Wald during a Department of Defense Briefing on May 4th, 1999 discussing Operation Allied Force:

Major General Wald: That's the problem with numbers. Everybody keeps saying don't say numbers because you'll go down a path of numbers. But the fact of the

matter is it may be more than that, it may be less, it may be 22.5 percent, it may be 31 percent; it may be something. But it's in a category that a big chunk of his tanks are gone.

Q: So if we can get a running count on it so we know on a daily basis...

Major General Wald: I'll tell you what. I've tried every day to call Milosevic and ask him, and he won't tell me. (Laughter)

...So we go down this path. Our concern is we're going to tell you something that's wrong. And the last thing we want to do is give you bad information, because our credibility means everything.²⁴

A similar remark was made by Major General Jertz at a NATO press conference.

Coming now to a very short update on numbers, however please bear in mind what I have said over and over again, numbers as such are not a very precise indicator of combat capability of a unit. The shortages of food, fuel, ammunition, the latter leading to a decrease and reduction of morale of the soldiers must all be taken into consideration. Since my presentation last week concerning the Serbian ground forces in Kosovo, we told you we had destroyed 306 pieces of heavy equipment. We have now raised the figure up to 432...²⁵

And the General continued to give three more paragraphs detailing the numbers and percentages of targets destroyed.

Even if the numbers are accurate, there is less direct correlation between physical damage and functional damage with respect to battlefield targets than with fixed structures. The earlier example of the tank factory is fairly logical and easy to analyze. Another example where the functional damage is easy to understand is a bridge. But how can physical damage be related to functional and target system damage for a tactical battlefield target? How many tanks must be destroyed for that unit to be incapable of offensive operations? Of maneuver? Or of defensive operations?

A study in *Army* in 1986 looked at casualty rates and their effect on the enemy commander. When US Army commanders were asked how high casualty rates would

have to be before they would surrender, the answers were generally close to 50 percent.²⁶

The study goes on to say that there is very little relation between casualties and defeat.

The most common reason for defeat cited was the use of maneuver by the enemy, and in these cases "recognition of defeat appears to have arisen from a look toward the future and an enemy's potential capabilities rather than towards the past and the casualties he has inflicted."²⁷ These findings, while derived from a study limited to ground operations, further support the point that it is not really about how many tanks are being destroyed, but what is the effect of that destruction on the enemy commander.

While it is within the operational commander's best interest to use every means available to achieve his objectives, there needs to be some consideration of the costs and benefits associated with the assets requested. National imagery intelligence assets can provide the operational commander with tactical BDA. However, the physical BDA on tactical targets taken from all available ISR assets, including satellites, aircraft, and UAVs, has historically been unreliable. Even if the physical damage assessment was accurate, the correlation between physical damage and functional / target system damage is difficult to quantify. National assets, although a great tool for the operational commander, are not a panacea for the problems associated with BDA.

For these reasons, while the operational commander should ask for whatever assets are available to assist him in BDA, theater and strategic commanders should evaluate the appropriateness of utilizing national assets in a tactical role. There is no "one" answer to this question, and the national level leadership will have to evaluate the *quid pro quo* for each given set of circumstances.

How should national assets be used for Tactical BDA?

It is likely that national assets will be used in the future to assist the operational commander in battle damage assessment of tactical targets. There are some ways to improve the utilization of these assets prior to the next conflict. As was stated earlier, it is difficult to separate the capabilities and limitations of the different imagery intelligence assets that contribute to the BDA effort. In a larger sense, nearly every recommendation made in reference to national imagery intelligence assets applies to theater and tactical assets also. National imagery intelligence assets are singled out as the most important of these assets because of their capability in support of other national and strategic goals that make optimization of their use most pressing.

First, some attempt should be made to quantify the capabilities available from national agencies to the joint force commander. Presumably, something like this has been done if for nothing more than appropriations decisions. To be usable, this would have to be more than simply the number of square kilometers per day that an asset can image. The limiting factor would most likely be the analysts, and the output would need to be expressed in some relative terms, such as the number of square kilometers that can be searched for armored vehicles per day. What is important to the operational commander is really not that he has one satellite available to him or even that he was 200,000 square kilometers of imagery per day. A relevant measurement would be that he could expect to image some percent of all the armored vehicles located in the open in a given area each day. Weather, terrain, and the enemy's deception effort are just a few of the factors that would modify what could only be considered a baseline number.

Once the capabilities of these limited assets are quantified, then they can be treated just like other ISR assets and other conventional forces. These capabilities could then be apportioned to the various commanders. Staff officers planning contingency operations could now make realistic expectations of what national imagery intelligence assets would be available to them in the event of a conflict. Measures of effectiveness and perhaps even force-related objectives would change if the planners realized that they could not reliably ascertain an accurate assessment of friendly attacks.

Another method for improving the utilization of national assets would be less reliance on them for physical damage assessment and more concern with functional and target system assessment. Consider again the example of a tank battalion. If the friendly commander's objective is to render it ineffective there are several ways to measure this. As was pointed out above, the pure casualty rate of tanks destroyed can be misleading (although it is certainly important). Perhaps a better metric would be the amount of fuel or ammunition arriving daily to support this battalion. Certainly this is a simplistic analogy and could be dismissed, but the point should be made that instead of focusing national assets on the number of tanks destroyed (a physical assessment), they may be used to a greater effect to determine the amount of re-supply the battalion is receiving (an indirect measurement of target system damage). It would presumably be easier to detect supply columns moving along roads than it would be to count the number of tanks or personnel carriers hidden in trees or urban areas.

Conclusion

As weapons technology continues to mature, some of the older methods of bomb damage assessment, such as overhead imagery, will become less and less effective. Increased stand-off and internally guided weapons have moved the shooter further and further away from the target. Many of these weapon systems have also allowed attacks on targets obscured by cloud cover. All these technologies will minimize the effectiveness of imagery taken by any ISR asset.

When this imagery is available, it is often inaccurate and may be misleading to the operational commander. Even accurate assessments of the physical damage done to the enemy sometimes shed little light on the enemy's capabilities or intentions. As the United States continues to move away from attritional warfare into effects-based targeting, the actual numbers will matter less and less. Perhaps General Clark expresses the best characterization of the situation when asked how many Serbian tanks had been destroyed by the end of Allied Force. The General would only respond: "Enough."²⁸

It is hard to picture a conflict where there will be enough ISR assets to meet all available intelligence requirements. Despite the advantages they offer, national imagery assets have many drawbacks when used for tactical battle damage assessment, such as their predictability, susceptibility to weather, variability of image quality, and limited numbers. With such a seemingly low return, the operational and theater commander should seriously evaluate the impact of using national sensors in the pursuit of damage assessment on tactical targets.

NOTES

¹ Joint Chiefs of Staff. Joint Doctrine for Targeting (Draft), Joint Pub 3-60 (Washington, DC, 6 June 2000), II-9-10.

² *Ibid.*, II-9.

³ Charles P. Vick, Sara D. Berman, and Christina Lindborg, "Improved Crystal," Federation of American Scientists - Space Policy Project. 9 September 2000, <<http://wwwfas.org/spp/military/program/imint/kh-12.htm>> [26 January 2001].

⁴ Craig Covault, "Recon Satellites Lead Allied Intelligence Effort," Aviation Week and Space Technology, 134 (4 February 1991): 25.

⁵ U.S. Congress. House, Committee on Armed Services. Intelligence Successes and Failures in Operations DESERT SHIELD / DESERT STORM. Report. (Washington, DC: US Govt. Printing Office, 1993), 27.

⁶ *Ibid.*, 43.

⁷ *Ibid.*, 27.

⁸ *Ibid.*, 30.

⁹ *Ibid.*, 31.

¹⁰ *Ibid.*, 44.

¹¹ Covault, 25.

¹² *Ibid.*, 7.

¹³ Donald Cordesman, The Lessons and Non-Lessons of the Air and Missile War in Kosovo (Washington DC 1999), 123.

¹⁴ Report to Congress: Kosovo/Operation Allied Force After-Action Report. 85-86.

¹⁵ *Ibid.*

¹⁶ Richard J. Newman, "The Bombs that Failed in Kosovo," U.S. News and World Report, 127 (20 September 1999): 30.

¹⁷ John Barry and Even Thomas, "The Kosovo Cover Up." Newsweek, 135 (May 15, 2000): 23.

¹⁸ Report to Congress: Kosovo/Operation Allied Force After-Action Report. 53.

¹⁹ JMO Department, "C4ISR and Information Operations in Kosovo – 1999 (Unclassified Extract)," (Newport: Naval War College, 2000), 8.

²⁰ Report to Congress: Kosovo/Operation Allied Force After-Action Report, 55.

²¹ Congressional Budget Office Report, quoted in Barbara Starr, "Satellites paved way to victory," Jane's Defense Weekly, 15 (9 March 1991): 330.

²² Chris Peat, "Geographical Distribution of Visitors to Heavens-Above." Heavens-Above. <<http://www.heavens-above.com/geodistrib.asp>> [26 January 2001].

²³ Cordesman, 22.

²⁴ As quoted in Donald Cordesman, The Lessons and Non-Lessons of the Air and Missile War in Kosovo (Washington DC 1999), 145-146.

²⁵ Ibid., 147.

²⁶ Robert McQuie, "Battle Outcomes: Casualty Rates as a Measure of Defeat," Army, (November 1987), 33.

²⁷ Ibid.

²⁸ As quoted in John Barry and Even Thomas, "The Kosovo Cover Up." Newsweek, 135 (May 15, 2000): 23.

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⁴ Craig Covault, "Recon Satellites Lead Allied Intelligence Effort," Aviation Week and Space Technology, 134 (4 February 1991): 25.

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⁶ Ibid., 43.

⁷ Ibid., 27.

⁸ Ibid., 30.

⁹ Ibid., 31.

¹⁰ Ibid., 44.

¹¹ Covault, 25.

¹² Ibid., 7.

¹³ Donald Cordesman, The Lessons and Non-Lessons of the Air and Missile War in Kosovo (Washington DC 1999), 123.

¹⁴ Report to Congress: Kosovo/Operation Allied Force After-Action Report, 85-86.

¹⁵ Ibid.

¹⁶ Richard J. Newman, "The Bombs that Failed in Kosovo," U.S. News and World Report, 127 (20 September 1999): 30.

¹⁷ John Barry and Even Thomas, "The Kosovo Cover Up." Newsweek, 135 (May 15, 2000): 23.

¹⁸ Report to Congress: Kosovo/Operation Allied Force After-Action Report. 53.

¹⁹ JMO Department, "C4ISR and Information Operations in Kosovo – 1999 (Unclassified Extract)," (Newport: Naval War College, 2000), 8.

²⁰ Report to Congress: Kosovo/Operation Allied Force After-Action Report. 55.

²¹ Congressional Budget Office Report, quoted in Barbara Starr, "Satellites paved way to victory," Jane's Defense Weekly, 15 (9 March 1991): 330.

²² Chris Peat, "Geographical Distribution of Visitors to Heavens-Above." Heavens-Above. <<http://www.heavens-above.com/geodistrib.asp>> [26 January 2001].

²³ Cordesman, 22.

²⁴ As quoted in Donald Cordesman, The Lessons and Non-Lessons of the Air and Missile War in Kosovo (Washington DC 1999), 145-146.

²⁵ Ibid., 147.

²⁶ Robert McQuie, "Battle Outcomes: Casualty Rates as a Measure of Defeat," Army, (November 1987), 33.

²⁷ Ibid.

²⁸ As quoted in John Barry and Even Thomas, "The Kosovo Cover Up." Newsweek, 135 (May 15, 2000): 23.